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The Effectiveness of the Algo-Art Module Based on Computational Thinking for Learning Painting Art Expression in Secondary Schools

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Abstract

The integration of computational thinking elements in Visual Arts Education is a teaching and learning approach that incorporates computational thinking into Visual Arts Education. This study aims to identify the effectiveness of integrating computational thinking elements in the Visual Arts Education subjects specifically for the Form Four painting expression topic. This research employs a quantitative methodology with a quasi-experimental design. The research location is a national secondary school in the Petaling Perdana district, Selangor. A total of 70 students were selected as research samples through purposive sampling, with 35 students assigned to the control group and the remaining 35 students assigned to the treatment group. Data collection was conducted through tests administered twice: a pre-test and a post-test. The research instrument was based specifically a painting practical assessment using the Malaysian Certificate of Education (SPM) examination format. The Independent Samples t-test at the pre-test stage showed no significant difference in mean scores between the control group and the treatment group. However, at the post-test stage, the Independent Samples t-test found that the mean score of the treatment group was significantly higher than the control group. These findings demonstrate the effectiveness of the computational thinking-based ALGO-ART module in enhancing painting expression skills among secondary school students. Consequently, the ALGO-ART module has brought innovation to visual arts teaching and learning methods by integrating computational thinking elements.

Keywords: Computational Thinking, Painting Expression, Visual Arts Education, Quasi-Experimental Design, ALGO-ART Module

Introduction

Visual Arts Education (PSV) is an important component in Malaysia's education system that aims to foster creativity and artistic skills among secondary school students (BPK, 2015). However, in this rapidly advancing digital era, traditional pedagogy in visual arts teaching has become less relevant to the needs of today's student generation (Indrawati, 2021). Furthermore, according to Rosy (2024) based on previous studies, teachers must adapt new approaches by implementing innovations in the teaching and learning process. Simon and Simon (2024) also support this argument that renewal in current pedagogy can prevent boring learning processes. In relation to this, based on findings from previous research, Mariana and

Kristanto (2023) state that the integration of computational thinking elements into PSV is seen as an innovative approach with potential to empower the teaching and learning process in this field.

Computational thinking is a form of cognitive skill that involves systematic and structured problem-solving processes through decomposition, pattern recognition, abstraction, and algorithms (Wing, 2017). Although computational thinking was originally associated with the field of computer science, its application has now been expanded to various disciplines including visual arts. Referring to research findings by Mohd Kusnan et al. (2020) through a systematic literature review, computational thinking activities in Malaysia began in 2017 through the subjects of Computer Science Fundamentals (ASK) and Computer Science (SK). However, extensive research is needed for integration into other subjects as well. In relation to this, findings from previous research by Yunianto et al., (2024) suggest that the integration of these two fields has the potential to create a new paradigm in Visual Arts Education (PSV) that is more responsive to 21st century needs. A study by Wang and Zhang (2021) found that teaching approaches that incorporate computational thinking in PSV have successfully enhanced students' ability to explore artistic ideas systematically and innovatively. Additionally, findings from previous research by Mohamad Yatim and Mohd Dazid (2020) reported that students exposed to this approach showed improvement in critical thinking and problem-solving skills compared to those following conventional teaching methods. In the local context, Noor and Ibrahim (2021) through their study in secondary schools in Selangor found that the integration of computational thinking elements in visual arts teaching has increased the level of student engagement and motivation.

Although there is empirical evidence showing the effectiveness of this approach (Khasyyatillah et al., 2024), specific research on integrating computational thinking in teaching art expression at the secondary school level remains limited, especially in the Malaysian context. Furthermore, previous studies have focused more on general academic achievement, based on research by Solutions et al., (2025), with less emphasis on students' specific artistic skill development. Recognizing this research gap, this study aims to identify the effectiveness of the ALGO-ART module, which is based on computational thinking, in enhancing painting art expression skills among Form Four students. The ALGO-ART module is specifically designed to integrate computational thinking elements such as decomposition, pattern recognition, abstraction, and algorithms into the teaching and learning process of painting art expression. Through a quasi-experimental approach, this study is expected to contribute to the development of knowledge and pedagogical practices in the field of Visual Arts Education, particularly in the Malaysian educational context.

Objectives and Significance

In general, this study aims to test the effectiveness of the ALGO-ART teaching module based on computational thinking in learning painting art expression. To achieve this goal, several objectives have been developed:

i. To identify the level of significant difference in mean scores between the treatment group compared to the control group in the Pre-Test
ii. To identify the difference in mean scores between the treatment group compared to the control group in the Post-Test

Research Objectives

To achieve these objectives, several research questions have been established:

i. Is there a significant difference in mean scores between the treatment group compared to the control group in the Pre-Test?
ii. Is there a significant difference in mean scores between the treatment group compared to the control group in the Post-Test?

Hipotesis

To answer these research questions, several research hypotheses have been established:
H01: There is no significant difference in mean scores between the treatment group and the control group in the Pre-Test
H02: There is no significant difference in mean scores between the treatment group and the control group in the Post-Test

Methodology

Design of Study

This study uses a quantitative research design because it measures the difference in test score percentages (Chua, 2006). Meanwhile, the research design is quasi-experimental because this study aims to evaluate the effectiveness (Creswell & Guetterman, 2020) of teaching and learning painting art expression that applies the integration of computational thinking elements. The instruments used are pre and post-tests to collect quantitative data from the Control Group (using conventional methods in learning) and the Treatment Group (using the ALGO-ART Module in learning). Quantitative research was conducted in this study with a quasi-experimental study involving pre-test and post-test as shown in Table 1 below.

Table 1
Quasi-Experimental Research Design

Treatment	X_1	T	X_2
Control	X_1	C	X_2

X_1=Pre-Test; X_2=Post-Test
T=Treatment-ALGO-ART Module; C=Control-Conventional

Sampling Method

This study involves 70 samples, which are Form Four students in the Visual Arts Education stream from a secondary school located in Petaling Perdana District, Selangor. Sample selection was made based on purposive sampling procedure (Ishak & Khalid, 2021). A total of 35 students (n=35) from the control group underwent learning sessions using conventional methods, while 35 students (n=35) in the treatment group underwent teaching and learning sessions using the ALGO-ART module based on computational thinking for learning painting art expression. Referring to findings from previous research by Augusto and Ojeda (2024), the Levene test was applied to test the hypothesis that the variance for the dependent variable across each group of independent variables in the study population is homogeneous. Therefore, a pre-test was implemented to determine homogeneity at the initial stage for both study sample groups (Ujian et al., 2022). To ensure the equivalence of the study groups, the findings of the Levene Test for equality of variance recorded a value of F=.255 with a significant level of p=.615 (p>.05), proving that the pre-test values between the control group and the treatment group were homogeneous (equal) before the implementation of this study.

Research Instruments

The instrument of this study is based on questions from paper 2 code 2611/2 of the Visual Arts Education subject, Malaysian Certificate of Examination. The testing is divided into two parts: drawing art practical and painting art practical. In this study, assessment is based on painting art practical. Theoverall score for the constructed instrument is 50 marks while the answering time is 3 hours. The instruments contained in the ALGO-ART module were developed and then given to five experts for validation. Three university lecturers, one Visual Arts Education teacher, and one Computer Science subject teacher were appointed as instrument validation experts.

Research Findings

Significant Difference in Mean Scores between the Treatment Group Compared to the Control Group in the Pre-Test

In this study, data was obtained using inferential research with Independent Samples t-Test comparative analysis. The purpose of conducting the comparative analysis was to analyze the effect of using the computational thinking integration module in teaching and learning painting art expression. The results of the independent samples t-test analysis showed that there was no significant difference between the treatment group (ALGO-ART Module) and the control group (conventional) for pre-test scores ($t(68) = 1.463$, $p = 0.148$, $p > 0.05$). The mean difference value of 0.8 indicates that although there was a slight difference in scores between the two groups, this difference was not sufficient to be considered statistically significant.

Table 2

Independent Samples T-Test Analysis Between Treatment (ALGO-ART Module) and Control Group (conventional) For Pre-Test Scores

	t	df	Sig.	Mean Difference
Pre-Test Score	1.463	68	0.148	0.8

This result indicates that both groups had an equivalent level of knowledge or skills before the intervention was conducted, and this fails to reject the first hypothesis.

Significant Difference in Mean Scores between the Treatment Group Compared to the Control Group in the Post-Test

Table 3

Independent Samples T-Test Analysis Between Treatment (ALGO-ART Module) and Control Group (conventional) For Post-Test Scores

	t	df	Sig.	Mean Difference
Post-Test Scores	7.76	68	<.001	4.23

Based on Table 3 which displays the results of the Independent Samples T-Test between the treatment group (ALGO-ART Module) and the control group (conventional) for post-test scores, the findings show that there is a significant mean difference between the two groups. Statistical analysis shows that the t-value is 7.76 with degrees of freedom (df) of 68, and a significant value (Sig.) less than .001 ($p < .001$). The mean difference of 4.23 points between the treatment group and the control group is statistically significant. This finding proves that the use of the ALGO-ART Module in the treatment group has provided a significant positive effect compared to the conventional method used in the control group. Therefore, the null hypothesis stating that there is no significant difference between the two groups in the post-test is rejected. In conclusion, empirical evidence shows that the ALGO-ART Module is more effective in improving student achievement compared to conventional methods.

Discussions

The impact of the ALGO-ART Module on students' performance in painting art expression can be clearly seen through detailed statistical analysis. Initial tests (pre-test) showed no major gap between the group using the ALGO-ART Module and the conventional group ($t(68) = 1.463$, $p = 0.148$). With just a 0.8-point difference, both groups were on equal footing before the study began, which helps confirm the reliability of the findings. But things changed after the intervention. Post-test results revealed a clear advantage for the ALGO-ART group, with a notable 4.23-point lead over the conventional group ($t(68) = 7.76$, $p < .001$). This strong statistical significance ($p < .001$) proves that the module made a real difference far beyond the tiny gap seen earlier. The jump from a 0.8-point to a 4.23-point difference shows that the improvement wasn’t random but directly linked to the ALGO-ART approach.

This study highlights how blending computational thinking breaking down problems, spotting patterns, simplifying concepts, and using structured steps can boost learning in Visual Arts. The ALGO-ART Module didn’t just match traditional teaching; it outperformed it, proving that mixing tech-driven logic with creative expression works. The takeaway? Innovative methods that merge computation and art don’t just add variety they deliver better results than conventional techniques.

Implications

This research offers key insights that could reshape how we approach visual arts education in terms of teaching methods, policy decisions, and further studies. The ALGO-ART Module's success in boosting students' painting skills highlights how blending computational thinking with art instruction could revolutionize traditional teaching approaches. These results give curriculum designers and policymakers a fresh template for updating arts education to better equip students with contemporary skills. The noticeable progress seen in students who experienced this method suggests schools should explore similar tech-infused strategies across different art disciplines.

Additionally, this research provides hands-on guidance for general classroom teachers tasked with teaching visual arts as part of a wider curriculum. The noticeable gap between students who received the blended approach and those who didn’t shows that even educators without deep technical knowledge can successfully weave computational thinking into traditional art lessons. Teacher training programs should start embedding computational thinking into their

courses, while ongoing professional development can help current educators master these techniques.

School leaders might use these findings to push for resources that break down the artificial barriers between STEM and the arts. When it comes to evaluating student progress, the research points to the value of using both pre- and post-assessments (Murphy et al., 2023) to get a fuller picture of what works. Future curricula should take note this dual approach gives a clearer measure of growth. The study also reminds us how crucial it is to ensure all students start on equal footing in educational research, emphasizing the need for tight, well-structured study designs.

This research also makes significant theoretical and practical contributions to visual arts education in several key ways. Theoretically, it advances the conceptual framework for interdisciplinary pedagogical approaches by empirically validating the integration of computational thinking within artistic domains. The study bridges previously separate educational paradigms, establishing a theoretical foundation for understanding how cognitive processes associated with computational thinking (decomposition, pattern recognition, algorithm and abstraction) can enhance artistic expression and learning.

Practically, the research provides evidence-based support for a concrete instructional methodology the ALGO-ART Module that demonstrates measurable improvement in student achievement. The statistically significant difference (4.23 points, $p < .001$) between treatment and control groups offers compelling empirical evidence that teachers can use to inform their classroom practices. This practical contribution is particularly valuable as it provides educators with a tested pedagogical approach that can be implemented to enhance student outcomes in painting and artistic expression, moving beyond theoretical constructs to offer actionable instructional strategies that combine computational thinking with traditional art education approaches.

Conclusion

The integration of computational thinking through the ALGO-ART Module represents an effective pedagogical approach in the context of art education. This finding supports the importance of innovation in teaching methods (Abd Majid & Mafarjaa, 2024) by incorporating elements of computational thinking to enhance students' mastery in the field of art (Anuar et al., 2021). This research opens up space for further studies on the integration of technology and computational thinking across various disciplines of art education, and suggests that such interdisciplinary approaches should be expanded and considered in the future development of Visual Arts Education curriculum. It is recommended that the approach of integrating computational thinking be considered in the future development of the Visual Arts Education curriculum. Teacher training in implementing this approach also needs to be emphasized to ensure the effectiveness of its implementation in the classroom.

In addition, this research significantly contributes to the existing knowledge base by providing the first empirical validation of computational thinking integration specifically in painting art expression at the secondary school level within the Malaysian context. While previous studies have explored computational thinking in general academic contexts, this research fills a critical gap by focusing on artistic skill development, thereby expanding the evidence base for

interdisciplinary approaches in creative education. The integration of decomposition, pattern recognition, abstraction, and algorithmic thinking within the ALGO-ART Module represents a significant theoretical advancement in understanding how cognitive processes traditionally associated with logical reasoning can enhance creative expression and artistic learning outcomes. Moreover, the research contributes to the discourse on educational equity by demonstrating that computational thinking integration can be successfully implemented by general classroom teachers without deep technical expertise. This discovery carries important consequences for making education more accessible and indicates that creative teaching methods can be effectively implemented beyond elite or well-funded schools. Within the Malaysian context, this research directly aligns with the Ministry of Education's focus on incorporating 21st-century competencies while simultaneously addressing the unique cultural and instructional requirements found in Malaysian high schools. Given that computational thinking activities in Malaysia began systematically in 2017 through Computer Science Fundamentals (ASK) and Computer Science (SK) subjects, this research represents a crucial expansion of computational thinking applications into humanities and arts education, aligning with Malaysia's broader educational digitalization agenda.

References

Abd Majid, M. Z., & Mafarjaa, N. (2024). Understanding the educational innovation practice in teaching and learning among economic teachers in Klang Valley. SHS Web of Conferences, 182, 01005. https://doi.org/10.1051/shsconf/202418201005

Anuar, N. H., Mohamad, F. S., & Minoi, J.-L. (2021). Art-integration in computational thinking as an unplugged pedagogical approach at a rural Sarawak primary school. International Journal of Academic Research in Business and Social Sciences, 11(14). https://doi.org/10.6007/ijarbss/v11-i14/8328

Augusto, C., & Ojeda, C. (2024). Levene's test for verifying homoscedasticity between groups in quasi-experiments in social sciences. XXV, 5–11.

BPK. (2015). Bahagian Perkembangan Kurikulum Kurikulum Standard Sekolah Menengah. Putrajaya: Kementerian Pendidikan Malaysia.

Chua, Y. P. (2006). Kaedah penyelidikan (Buku 1). Kuala Lumpur: McGraw Hill Education.

Creswell, J. W., & Guetterman, T. C. (2020). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (6th ed.). Pearson Education.

Field, A. (2011). Discovering statistics using SPSS (4th ed.). SAGE Publications.

Indrawati, L. (2021). Study approach based on art appreciation "should" be an option in art learning during online study. KnE Social Sciences, 5(6), 207–212. https://doi.org/10.18502/kss.v5i6.9197

Ishak, N. S., & Khalid, F. B. (2021). Penggunaan video YouTube bagi meningkatkan minat dan pencapaian murid dalam pembelajaran Geografi Fizikal di sekolah menengah. Malaysian Journal of Social Sciences and Humanities, 6(3), 228–240. https://doi.org/10.47405/mjssh.v6i3.708

Khasyyatillah, I., Osman, K., & Husnin, H. (2024). Pengintegrasian pemikiran komputasional melalui aplikasi mudah alih untuk meningkatkan disposisi pemikiran komputasional. Jurnal Pendidikan Malaysia, 49(2), 99–110.

Mariana, E. P., & Kristanto, Y. D. (2023). Integrating STEAM education and computational thinking: Analysis of students' critical and creative thinking skills in an innovative teaching and learning. Southeast Asian Mathematics Education Journal, 13(1), 1–18. https://doi.org/10.46517/seamej.v13i1.241

Mohamad Yatim, M. H., & Mohd Dazid, N. D. (2020). Effectiveness of applying computational thinking in game-based learning (GBL) for year three topic basic of multiplication. International Journal of Education, Psychology and Counseling, 5(35), 125–141. https://doi.org/10.35631/ijepc.5350012

Mohd Kusnan, R., Tarmuji, N. H., & Omar, M. K. (2020). Sorotan literatur bersistematik: Aktiviti pemikiran komputasional dalam pendidikan di Malaysia. Malaysian Journal of Social Sciences and Humanities, 5(12), 112–122. https://doi.org/10.47405/mjssh.v5i12.581

Murphy, D. H., Little, J. L., & Bjork, E. L. (2023). The value of using tests in education as tools for learning not just for assessment. Educational Psychology Review, 35(3), 1–21. https://doi.org/10.1007/s10648-023-09808-3

Noor, H., & Ibrahim, I. R. (2021). The design and development of Bijak Seni: A teaching and learning module that incorporates computational thinking skills in visual art education for secondary school. Social Science Research Network. https://doi.org/10.2139/ssrn.3791181

Rosy, B. C. G. (2024). Innovations in teaching practices. International Research Journal on Advanced Engineering and Management, 2(5), 1469–1471. https://doi.org/10.47392/irjaem.2024.0198

Solutions, S., Sarji, A., Hamed, A., Wong, S. L., Zariat, M., Rani, A., Khambari, M. N., Rahim, A. A., & Moses, P. (2025). Integrating computational thinking into Malaysian STEM education: Challenges, opportunities, and strategic solutions. STEM Research Proceedings, March.

Simon, S. C., & Simon, S. (2024). Keberkesanan penggunaan interaktif e-learning berasaskan aplikasi Quizizz bagi topik norma masyarakat global dalam Pendidikan Moral Tingkatan Lima. International Journal of Modern Education, 6(22), 247–266. https://doi.org/10.35631/ijmoe.622019

Ujian, K., Abdullah, N. F., & Muda, N. (2022). An overview of homogeneity of variance tests on various conditions based on type 1 error rate and power of a test. Journal of Quality Measurement and Analysis, 18(3), 111–130.

Wang, M., & Zhang, L. (2021). The role of STEAM education in developing mathematical thinking skills in high school students. Mathematics Education Research Journal, 33(2), 153–167.

Wing, J. M. (2017). Computational thinking's influence on research and education for all. Italian Journal of Educational Technology, 25(2), 7–14. https://doi.org/10.17471/2499-4324/922

Yunianto, W., Cahyono, A. N., Prodromou, T., El-Bedewy, S., & Lavicza, Z. (2024). CT integration in STEAM learning: Fostering students' creativity by making Batik stamp pattern. Science Activities, 62(1), 1–27. https://doi.org/10.1080/00368121.2024.2378860